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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/748,546	12/30/2003	Alex Nugent	1000-1215	9090

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EXAMINER	
HIRL, JOSEPH P	

ART UNIT	PAPER NUMBER
2129	

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09/11/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/748,546	NUGENT, ALEX	
	Examiner	Art Unit	
	Joseph P. Hirl	2129	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 July 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *21-41* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *21-41* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action is in response to an AMENDMENT entered July 25, 2007 for the patent application 10/748,546 filed on December 30, 2003.

2. All prior office actions are fully incorporated into this Final Office Action by reference.

Status of Claims

3. Claims 21-41 are pending in this application.

Request for Information

4. In accordance with CFR § 1.105, please provide detailed test data, appropriate written description of the meaning of such test data including pictures of test setup to demonstrate that the claimed invention has been reduced to practice. A reply that such information is not available will be considered that the claimed invention has not been reduced to practice.

Applicant has referenced in the response dated July 25, 2007 the art of Hong (Korea University, Controllable Capture of Au Nano-Particles by using Dielectrophoresis, December 2004) which was not provided with the subject response.

In response to this office action, applicant is required to submit a copy of Hong to make the record complete.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claims 21-41 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Proof of a constructive reduction to practice requires sufficient disclosure under the "how to use" and "how to make" requirements of 35 U.S.C. 112, first paragraph. Kawai v. Metlesics, 480 F.2d 880, 886, 178 USPQ 158, 163 (CCPA 1973). Any analysis of whether a particular claim is supported by the disclosure in an application requires a determination of whether that disclosure, when filed, contained sufficient information regarding the subject matter of the claims as to enable one skilled in the pertinent art to make and use the claimed invention. The standard for determining whether the specification meets the enablement requirement was cast in the Supreme

Court decision of Mineral Separation v. Hyde, 242 U.S. 261, 270 (1916) which postured the question: is the experimentation needed to practice the invention undue or unreasonable? That standard is still the one to be applied. In re Wands, 858 F.2d 731, 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988). Accordingly, even though the statute does not use the term "undue experimentation," it has been interpreted to require that the claimed invention be enabled so that any person skilled in the art can make and use the invention without undue experimentation. In re Wands, 858 F.2d at 737, 8 USPQ2d at 1404 (Fed. Cir. 1988). See also United States v. Telectronics, Inc., 857 F.2d 778, 785, 8 USPQ2d 1217, 1223 (Fed. Cir. 1988) ("The test of enablement is whether one reasonably skilled in the art could make or use the invention from the disclosures in the patent coupled with information known in the art without undue experimentation.").

From In re Wands, the factors to be considered in determining whether a disclosure would require undue experimentation are considered as follows:
Examiner's Note: In responding, the Examiner will use the art cited by the applicant in response to the office action dated July 23, 2007; Hong et al., Controllable Capture of Au Nano-Particles by Using Dielectrophoresis, December 2004, referred to as Hong. While such art is not prior art, it does indeed provide an insight to the level of skill existing at the time of the applicant's filing dated December 15, 2003.

The subject art by Hong was prepared by S. H. Hong, H. K. Kim, B. C. Kim, Y. S. Choi of the Department of Electronics and Computer Engineering, Korea University; J. S. Hwang and D. Ahn of the Institute of Quantum Information Processing and Systems, University of Seoul, S. K. Kwak and D. J. Ahn of the Department of Chemical and

Biochemical Engineering, Korea University; and S. W. Hwang of the Department of Electronics and Computer Engineering, Korea University and such art was published in the Journal of the Korean Physics Society. Such a group of individuals, referred to as University Group, cannot be considered at the level of one of ordinary skill in the art.

A. The quantity of experimentation necessary: The University Group, in the art printed one year after the filing of the applicant's application write of the difficulty in controllably capturing of Au nano-particles by using dielectrophoresis (page s665,column 2, lines 3-24). Applicant in the specification fails to identify the "how to make" electromechanical neural network that is expected to come about from a plurality of nanoconductors in a dielectric solution such that one of ordinary skill in the art can replicate the invention ... one of ordinary skill in the art is not at the level of the University Group and that University Group had difficulty achieving their result at their level of skill one year after the applicant filed the application. The quantity of experimentation by one of ordinary skill in the art is undue ...

B. The amount of direction and guidance: The rationale of item A above applies. Applicant in the Remarks, dated July 23, 2007, page 10, lines 10-13 states: "Applicant presents the following discussion to demonstrate that the nanoconnections formed in a solution and attracted to a connection gap (rather than electrodes) is based on practical principles and can function as a neural network." Anyone of the pictures shown in Fig. 2 of Hong do not resemble the proposed network of Applicant identified in Fig. 3 of the specification. Applicant's direction in the "how to make" such that one of ordinary skill in the art can replicate the invention has not been found in the specification.

C. The presence or absence of working examples: In the Office Action dated May 22, 2007, a request was made for test data and pictures of test documentation related to the invention (see ¶ 4. above) and none has been provided. Further, no statement by the applicant has been made that such material has not been provided because it does not exist ... an attempt to substitute using the art of Hong was made. Based on the action by the applicant, it can only be assumed that working examples do not exist ... no enablement.

D. The nature of the invention: The essence of the invention requires special skills on a multidisciplinary basis exhibited by the University Group of Hong... skills not to be found in one of ordinary skill in the art.

E. The state of the prior art: The University Group of Hong sets forth such considerations on page S665, column 2, lines 3-24 at a point in time one year after applicant's filing of the application. It would be significantly beyond one of ordinary skill in the art to replicate the invention by filling using the skill of one of ordinary skill in the art at the time of the invention to create the invention represented by the specification ... the neural network could not be constructed.

F. The relative skill of those in the art: Simply stated, such skills were not at the level of the University Group of Hong one year after filing of the application.

G. The predictability or unpredictability of the art: The issue is control of an object in a solution with physical features that is of the order of nm. The University Group cites in the Hong art at page S666, column 1, lines 1-4, the systematic experimentation necessary to achieve the results noted in the Hong art. Figs. 2 and 3

of Hong cite the effects of parameter variation for Au Nano-particles. Such data represents variability in results but only addresses Au Nano-particles. The real issue is how does one assemble something like Fig. 3 of the applicant specification in a repeatable manner ... or just once such that it represents a connection network that can be use in assembling a neural network.

H. The breath of the claims: The claims broadly cover an electromechanical liquid state machine formed by a plurality of nanoconductors suspended in a liquid dielectric solution between two electrodes to form a neural network nanoconnections of a connection network.

7. Claims 21-41 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The above discussion regarding enablement applies. The specification starting on page 13 – page 105 does not set forth the "how to make" an electromechanical liquid state machine formed by a plurality of nanoconductors suspended in a liquid dielectric solution between two electrodes to form a neural network nanoconnections of a connection network. While control of electrical characteristics might be helpful, one has to first have the basis of the neural network which the applicant has not disclosed and has not provided in the request made in the Office Action dated May 22, 2007.

Prior Art Anticipation

5. Applicant's concept of a liquid dielectric solution comprising a mixture of a plurality of nanoconductors and a liquid dielectric solvent wherein a plurality of nanoconductors are free to move about in a dielectric solution and such solution is disposed between two electrodes is anticipated by Paul M. Adriani and Alice P. Gast in the article entitled "Electric-field-induced aggregation in dilute colloidal suspensions" published in 1990 by the Faraday Discussions of the Chemical Society. The abstract is cited as follows:

> Electric-field-induced chain formation in dilute, non-agueous suspensions of sterically stabilized, 1 μm poly (methyl methacrylate)(PMMMA) lattices are investigated. Optical microscopy and digital image analysis provide the chain-length distribution. We find that the particles carry a charge sufficient to inhibit field-induced aggregation. Equilibrium predictions of chain aggregation incorporating a screened Coulombic repulsion and field-induced dipole attraction agree with experimental observations near the onset of aggregation; chain formation becomes diffusion limited above the threshold field strength.

Related to terminology, applicant has not defined the term Nanotechnology. From the web @ www.answers.com/nanotechnology, the following definition was obtained:

Nanotechnology: the science and technology of building devices, such as electronic circuits, from single atoms and molecules.

From Nanotechnology web site created by Dr. Ralph Merkle, the statement is made that the "word nanotechnology has become very popular and is used to describe many types of research where characteristic dimensions are less than about 1,000 nanometers" (micron range). http:www.zyvex.com/nano/

Applicant has not defined "nanotechnology" related to a specific numeric scale. However, applicant has made the following size comparison @ specification, page 6, lines 15-18:

> Microelectrical nano-size components include transistors, resistors, capacitors and other nano-integrated circuit components. MEMS devices include, for example, micro-sensors, micro-actuators, microinstruments, micro-optics, and the like.

Such definition is entirely consistent with the above cited definitions/intent.

Related to terminology, applicant refers to solvent in the generic sense in the specification, page 26, ¶ 00104, that includes a condition of suspension.

Related to terminology, applicant refers to a liquid dielectric solution without any explicit definition of dielectric. Dielectric means, to one of ordinary skill in the art, a non-conducting or insulating substance which resists passage of electric current, allowing electrostatic induction to act across it.

Adriani et al. cites the following on page 20, line 1:

> Particles having aligned dipoles will aggregate into chains.

Mehrotra et al. in Elements of Artificial Neural Networks cites the nature of neural networks to include a feed forward neural network in Figure 1.15 on page 20; the adaptive linear element of Figure 2.8 with weight adjustments into a summation circuit with a training algorithm identified in Figure 2.9 on page 59. Mehrotra, among others, assert neural networks with layers of nodes feeding with a plurality of connections into a plurality of nodes at the next layer

Therese C. Jordan et al. writing in 1989 in the IEEE, Entitled "Electrorheology" cites a graphic illustration of dipole arrangement in the presence of an electric field in figure 16. on page 867 which was copied from an article published in 1978 by H.A. Pohl,

entitled: Dielectrophoresis: The behavior of neural matter in nonuniform fields. Such arrangements follow dipole to dipole aligned to the field between the electrodes. There is no evidence of dipoles forming nodes and dipoles crossing from one chain to other chains as is required in the formation of neural networks. Further, in the cited Coulombic repulsion, such repulsion will prevent extension of dipoles. Additionally, there is no formation of chains to form weights to adjust values at a given node.

The evidence shown in the cited papers demonstrates that the concept disclosed by the applicant and cited below will not function as a neural network:

> A mechanism for applying an electric field across said connection gap, said mechanism electrically connected to said at least one pre-synaptic electrode and said at least one post-synaptic electrode, whereby said electric field induces a dipole in each nanoconductor among said plurality of nanoconductors only when said plurality of nanoconductors is located within said liquid dielectric solution and attracting said plurality of nanoconductors to said connection gap in order to provide to neural network nanoconnections of a connection network between said at least one pre-synaptic electrode and said at least one post synaptic electrode within said liquid dielectric solution, said connection network, said liquid dielectric solution, said plurality of nanoconductors, said at least one pre-synaptic electrode and said at least one post-synaptic electrodes electromechanically operable in combination with one another to comprise said electromechanical-based liquid state machine, which stores via patterns of neural activations of said neural network nanoconnections, a recent past history of said electromechanical-based liquid state machine.

Adriani et al. and Jordan et al. describe liquid state equivalents of applicant's electromechanical-based liquid state machine ... albeit without a neural network. Given that the dipoles align as described by Adriani et al. and Jordan et al. into chains (and as

demonstrated by them), a neural network will not form nor will a trained neural network form ... one simply has chains of varying lengths. In consequence, the prior art conclusively establishes that the invention of the applicant will simply not function as a neural network.

Claim Rejections - 35 USC § 101

6. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

7. Claims 21-41 are rejected under 35 U.S.C. 101 because the claimed invention lacks patentable utility. See ¶ 5. above. The neural network that is claimed cannot develop and the whatever network that may develop, cannot function as a neural network because it is not a neural network ... chains are not neural networks.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

9. Claims 21-41 are rejected under 35 USC 112, first paragraph because current case law (and accordingly, the MPEP) require such a rejection if a 101 rejection is given because when Applicant has not in fact disclosed the practical application for the invention, as a matter of law there is no way Applicant could have disclosed how to practice the undisclosed practical application. This is how the MPEP puts it:

> ("The how to use prong of section 112 **incorporates as a matter of law** the requirement of 35U.S.C. 101 that the specification disclose as a matter of fact a practical utility for the invention.... If the application fails as a matter of fact to satisfy 35 U.S.C. 101, then the application **also fails as a matter of law** to enable one of ordinary skill in the art to use the invention under 35 U.S.C. § 112."); In re Kirk, '376 F.2d 936, 942, 153 USIPQ 48, 53 (CCPA 1967) ("Necessarily, compliance with § 112 requires a description of how to use presently useful inventions, **otherwise an applicant would anomalously be required to teach how to use a useless invention**."). See, MPEP 21107.01 (IV), quoting In re Kirk (emphasis added).

10. Therefore, claims 21-41 are rejected on this basis.

Claim Rejections - 35 USC § 102/§ 103

11. Claims 21-41 fail to identify an invention that can be evaluated under the conditions of novelty or nonobviousness. Since the approach taken using nanoconductors fails to produce a neural network, the claims as written have no basis in reality and cannot be evaluated because the invention doesn't and cannot exist. See ¶ 5. above.

Response to Arguments

12. Applicant's arguments filed on July 25, 2007 related to Claims 21-41 have been fully considered but are not persuasive.

In reference to Applicant's argument:

Applicant's discussion of pages 10-13 regarding Request for Information under 37 CFR §1.105 are acknowledge.

Examiner's response:

Above discussion at ¶ 5 applies. Since the disclosure is lacking in both enablement and written description, constructive reduction to practice cannot be asserted and it must be concluded that the invention as disclosed simply does not exist.

In reference to Applicant's argument:

"... As soon as a conducting nanoparticle touches an electrode there can be no electric field between the nanoparticles and the electrode because their electric potentials are equal."

Examiner's Response:

Such is not in reality the case. Since there is a small electric current flowing and the connecting mechanism has resistance, there is a voltage gradient along the line and hence the argument that the gradient is zero never happens and therefore the argument that "One can argue that the particle was in fact attracted to the electrode gap and not the electrode." is misplaced. Further, applicant's discussion of page 12 lines 1-24 concerning "chains", Hong's Fig.2(e) shows nanoparticles cluster together which can be considered as linked or chained ... in the sense that dielectrophoretic force exists across adjacent particle for the reasons cited above.

In reference to Applicant's argument:

In the Office Action dated May 22, 2007, the Examiner provided a discussion of "Prior Art Anticipation". The Examiner, however, did not indicate under which specific section of 35 U.S.C 102 (a, b, c, d, etc?) this discussion relates. The Examiner argued that Applicant's concept of a liquid dielectric solution comprising a mixture of a plurality of nanoconductors and a liquid dielectric solvent wherein a plurality of nanoconductors are free to move about in a dielectric solution and such solution is disposed between two electrodes is anticipated by Paul M. Adriani and Alice P. Gast in the article entitled "Electric-field-induced aggregation in dilute colloidal suspensions" (hereinafter referred to as Adriani) published in 2990 by the Faraday Discussions of the Chemical Society. The abstract is cited as follows;

> Electric-field-induced chain formation in dilute, non-aqueous suspensions of sterically stabilized, 1 μm poly (methyl methacrylate) (PINNA) lattices are investigated. Optical microscopy and digital image analysis provide the chain-length distribution. We find that the particles carry a charge sufficient to inhibit field-induced aggregation. Equilibrium predictions of chain aggregation incorporating a screened Coulombic repulsion and field-induced dipole attraction agree with experimental observations near the onset of aggregation; chain formation becomes diffusion limited above the threshold field strength.

The Applicant respectfully disagrees with this assessment. The abstract and reference cited by the Examiner relates to the formation of "chains" in non-aqueous suspensions. Applicant is not developing electric-field induced chain formations. A "chain" implies direct connections between the colloidal particles as described in the Adriani paper. A chain is a series of things depending on each other as if linked together. Applicant's invention, on the other hand, relates to an adaptive synaptic element comprising a plurality of nanoconductors suspended and free to move about in a liquid dielectric solution located within a connection gap formed between at least one pre-synaptic electrode and at least one post-synaptic electrode. Thus, Applicant's invention does not rely on the use of a "chain" but is instead composed of nanoconductors that are suspended and free to move in the dielectric solution and not subject to a chain formation as is the case with the Adriani reference. Additionally, Adriani teaches the use of electroheological fluids, which are not dielectric solutions. Additionally, there is no teaching in Adriani of any type of a neural network or neural network components such as synapses. Also, Applicant's invention does not rely up on colloidal suspensions. In fact, the use of a colloidal suspension would be detrimental to the workings of Applicant's invention due to the fact that colloidal particles in colloidal suspensions are typically not on the nanometer scale.

Examiner's Response:

Appropriate reference to 35 USC §102/103 was made on page 8 of the Office Response dated May 22, 2007. ¶ 16. applies. For the reasons cited above concerning current flow, applicant's nano objects are linked. Dielectric merely relates to the aspect of conduction which is a characteristic of electroheological. Adriani teaches dense complex networks. Again the nanometer scale is not specifically defined by the

applicant ... $X*10^{-9}$ is a nanometer scale where X could be any real number .... 1000 .... 10000 ... whatever.

In reference to Applicant's argument:

The Examiner further asserted that Related to terminology, Applicant has not defined the term Nanotechnology. The Examiner cites From the web @ www.answers.com/nanotechnology, the following definition: Nanotechnology: the science and technology of building devices, such as electronic circuits, from single atoms and molecules.

The Examiner referred to the Nanotechnology web site created by Dr. Ralph Merkle, the statement is made that the "word nanotechnology has become very popular and is used to describe many types of research where characteristic dimensions are less than about 1,000 nanometers" (micron range). http p: wwwzyvex.com.nano/.

The Examiner argued that the Applicant has not defined "nanotechnology" related to a specific numeric scale. The Examiner cited Applicant's specification regarding size comparison @ specification, page 6, lines 15-18:

> Microelectrical nano-size components include transistors, resistors, capacitors and other nano-integrated circuit components. MEMS devices include, for example, micro -sensors, micro-actuators, microinstruments, micro-optics, and the like.

The Examiner argued that the Applicant indicated that such definition is entirely consistent with the above cited definitions/intent.

The Applicant respectfully disagrees with this assessment. The Applicant has defined "nanotechnology" related to a specific scale. See Paragraph [0016] of Applicant's specification, which indicates the following:

> The term "Nanotechnology" generally refers to nanometer-scale manufacturing processes, materials and devices, as associated with, for example, nanometer-scale lithography and nanometer-scale information storage.

Thus nanotechnology is something that must be at least on the nanometer scale. Adriani is not a nanotechnology reference as there is no teaching of "nanometer-scale" components and devices. In fact, Page 23, Paragraph 5, Lines 1-2 of Paragraph 5, of the Adriani reference specification indicates the following dimensions:

> "We measure suspension conductivity...in a stainless steel Couette cell of a 13 mm cylinder with a 12 mm radius and a gap of ca. 0.5 mm"

This is not a nanometer-scale device. Instead these dimensions (millimeters) are much larger. Thus, Adriani is not a nanotechnology-based device

For these reasons (e.g., Adriani is not nanotechnology, electroheological fluids are not dielectric in nature, no teaching or hint in Adriani of neural networks, synapses, etc), Adriani does not anticipate Applicant's invention.

Examiner's Response:

¶ 16. applies. $X*10^{-9}$ is a nanometer scale where X could be any real number .... 1000 .... 10000 ... whatever. Appropriate guidance in the interpretation of claims is provided by In re American Academy of Science Tech Center, 367, F.3d 1359,1369, 70 USPQ2d 1827, 1834, (Fed. Cir. 2004). Specifically, "Although claims of issued patents are interpreted in light of the specifications, prosecution history, prior art and other claims, this is not the mode of claim interpretation to be applied during examination. During examination, the claims must be interpreted as broadly as their terms reasonably allow."

In reference to Applicant's argument:

The Examiner further stated that related to terminology, Applicant refers to a solvent in the generic sense in the specification, page 25, ¶ 0099, that includes a condition of suspension.

Related to terminology, the Examiner also asserted that the Applicant refers to a liquid dielectric solution without any explicit definition of dielectric. The Examiner argued that dielectric means, to one of ordinary skill in the art, a non\- conducting or insulating substance which resists passage of electric current, allowing electrostatic induction to act across it. The Examiner argued that a liquid dielectric solution will inherently have an electric conductance that is less than that when the subject solution has conducting material suspended in it such as the claimed nanoconductors.

The Applicant cited Adriani, the following on page 20, line 1:
Particles having aligned dipoles will aggregate into chains.

The Applicant again submits that the use of dipoles aggregated into chains is not a feature of Applicant's invention and in fact would not function in the context of Applicant's invention, because Applicant's nanometer scale nanoconductors do not form chains or links as is the case with the Adriani reference. Instead, Applicant's invention provides for nanometer scale nanoconductors that are disposed and free to move about in the dielectric solution, not chained to one another, even after application of an electric field.

The Examiner further argued that Mehrotra et al. in Elements of Artificial Neural Networks cites the nature of neural networks to include a feed forward neural network in Figure 1.15 on page 20; the adaptive linear element of Figure 2.8 with weight adjustments into a summation circuit with a training algorithm identified in Figure 2.9 on page 59. The Examiner asserted that Mehrotra, among others, assert neural networks with layers of nodes feeding with a plurality of connections into a plurality of nodes at the next layer. Applicant notes that Mehrotra provides no teaching whatsoever of nanotechnology based devices. In fact Mehrotra provides only for a teaching of software-based neural network solutions, not actual physical

artificial neural networks. For example, page 46, section 2.3 of Mehrotra provides for a detailed discussion of a "perceptron training algorithm". An algorithm is not "physical" but is instead a mathematical and hence software construct. One skilled in the art would not look to Mehrotra for a teaching of a nanometer-scale physical neural network device. Mehrotra is simply one of many references dealing with software-based neural network solutions. Applicant's solution overcomes the problems with software/algorithm neural networks.., There is a discussion of software-based problems in Applicant's specification so there is no need to repeat that here.

Page 17, lines 13-28, page 18, lines 1-27 are acknowledged.

Examiner's Response:

The reference cited related to specification, page 25, ¶ 0099 was cited in application 10/735,934 and was not cited in the instant application ... miss quoted reference. As noted above, ¶ 16. applies. $X*10^{-9}$ is a nanometer scale where X could be any real number .... 1000 .... 10000 ... whatever. Appropriate guidance in the interpretation of claims is provided by In re American Academy of Science Tech Center, 367, F.3d 1359,1369, 70 USPQ2d 1827, 1834, (Fed. Cir. 2004). Specifically, "Although claims of issued patents are interpreted in light of the specifications, prosecution history, prior art and other claims, this is not the mode of claim interpretation to be applied during examination. During examination, the claims must be interpreted as broadly as their terms reasonably allow." Further, additional comments related to applicability of the cited references were cited in the Office Action dated May 22, 2007. Acknowledged statements are not referenced to a specific claim and related limitations.

In reference to Applicant's argument:

The Examiner also referred to Therese C. Jordan et al. writing in 1989 in the IEEE, Entitled "Electrorheology" in order to cite a graphic illustration of dipole arrangement in the presence of an electric field in figure 16. on page 867 which was copied from an article published in 1978 by H. A. Pohl, entitled: Dielectrophoresis:~ The behavior of neural matter in nonuniform fields. The Examiner argued that arrangements follow dipole to dipole aligned to the field between the electrodes. The Examiner also

argued that there is no evidence of dipoles forming nodes and dipoles crossing from one chain to other chains as is required in the formation of neural networks. (Note: Applicant does not form chains) The Examiner also argued that, in the cited Coulombic repulsion, such repulsion will prevent extension of dipoles. (Note.: Applicant does not use Coulombic repulsion) The Examiner further argued that there is no formation of chains to form weights to adjust values at a given node. (Note. Again, Applicant does not form chains). The Applicant notes that such arguments do not make sense in light of the Hong reference, particularly given the field of electrorheology is completely different from that of the field taught by Applicant's invention and is in fact irrelevant with respect to Applicant's invention. The Applicant invites the Examiner to review the Hong reference, which does not teach "chains" or Coulombic repulsion, but instead shows nanoconnections attracted to an electrode gap (and not electrodes), and is not based at all upon electrorheology.

Note the ability to be attracted to the connection gap is a claim limitation of Applicant's claims, for example, see claim 1 which includes the following:

> a mechanism for applying an electric field across said connection gap, said mechanism electrically connected to said at least one pre-synaptic electrode and said at least one post-synaptic electrode, whereby said electric field induces a dipole in each nanoconductor among said plurality of nanoconductors only when said plurality of nanoconductors is located within said liquid dielectric solution, thereby aligning said plurality of nanoconductors within said liquid dielectric solution and attracting said plurality of nanoconductors to said connection gap in order to provide to neural network nanoconnections of a connection network between said at least one pre-synaptic electrode and said at least one post-synaptic electrode within said liquid dielectric solution, said connection network, said liquid dielectric solution, said plurality of nanoconductors, said at least one pre -synaptic electrode and said at least one post-synaptic electrodes electromechanically operable in combination with one another to comprise said electromechanical-based liquid state machine, which stores via patterns of neural activations of said neural network nanoconnections, a recent past history of said electromechanical-based liquid state machine.

Examiner's Response:

¶ 16. applies. Applicant has not provided any test data evidence that chains do not form and that Coulombic repulsion is not present. Applicant's mere denial in the face of physical laws simply is a non starter. Applicant has not shown how the field of electroheology is relevant to that of the applicant's invention. Applicant is invited to review MPEP 2131.05 regarding nonanalogous art as related to rejections under § 102.

In reference to Applicant's argument:

The Examiner argued that the evidence shown in the cited papers demonstrates that the concept disclosed by the applicant and cited below will not function as a neural network. The Applicant submits that this is incorrect as the Hong reference demonstrates that nanoconnections can be formed in dielectric solutions. The connections of the Hong reference could modified for use in forming a neural

network, which is a discovery first realized by the Applicant. Hong does not of course teach a neural network. Applicant's innovation is the ability to form nanoconnections in a dielectric solution and then using such components as a basis for forming a neural network.

Based on the foregoing, the Applicant submits that the Adriani et al. and Jordan et al. references are not anticipated equivalents of Applicant's electromechanical-based liquid state machine Applicant's invention is not based on the use of "chains". The Examiner has not conclusively established that the invention of the Applicant will simply not function as a neural network, simply because the references cited by the Examiner either do not anticipate Applicant's invention or are irrelevant.

Examiner's Response:

¶ 16. applies. Applicant's arguments are not referenced to a specific claim limitation. Hong provides no basis to support neural network nanoconnections as applicant admits in the response dated July 25, 2007, page 20, lines 6-7. Applicant has not demonstrated that chains will not form. Again, applicant is invited to review MPEP 2131.05 regarding nonanalogous art as related to rejections under § 102.

In reference to Applicant's argument:

The Applicant also note that none of the references provide for any teaching whatsoever of a liquid state machine., What exactly is a "liquid state machine" (LSM)? The conceptual framework of an LSM facilitates the analysis of the real- time computing capability of neural microcircuit models. It does not require a task- dependent construction of a neural circuit, and hence can be used to analyze computations on quite arbitrarily "found" or constructed neural microcircuit models. An LSM also does not require any a-priori decision regarding the "neural code" by which information is represented within the circuit, A good summary of what an LSM is can be found at the following web site:

http://en.wikipedia.org/wiki/Liquid State Machine

In citing Mehrotra, Jordan, Adriani, and Merkle, the Examiner was silent on the issue of the LSM. None of these references, either individually or in combination with one another, teach an LSM. Of course, it must be appreciated that the LSM to date has been entirely a computational model, unlike Applicant's invention, which is a physical device. There has not been an actual physical hardware and nanotechnology based liquid state machine developed to date. The basic idea of an LSM as an LSM is known by those skilled in the art is that a neural (recurrent) microcircuit may serve as an unbiased analog (fading) memory (informally referred to as "liquid"' but of course not really a "liquid") about current and preceding inputs to the circuit. The "liquid state" refers to the analogy of a liquid but is not of course in and of itself a liquid. The word liquid in the name of the LSM comes from the analogy drawn to dropping a stone into a still body of water or other liquid. The falling stone will generate ripples in the liquid. The input (motion of the falling stone) has been converted into a spatio-temporal pattern of liquid displacement (ripples).

Examiner's Response:

¶ 16. applies. Applicant is reminded that wikipedia is a popular dictionary written by whomever and carries with it the possibility that the applicant participated in the definition. If applicant persist in limiting as a liquid state machine, then product-by-process rejections will follow since the neural network product will have been assembled as the process of a liquid state device. The analogy has no relevance to the basis of patent law.

In reference to Applicant's argument:

The discussion in the response dated July 25, 2007, page 21, line 13 to page 26, line 8 is acknowledged.

Examiner's Response:

The discussion related to principally liquid state machine in the response dated July 25, 2007, page 21, line 13 to page 26, line 8 relates to material not disclosed in the specification, except for ¶¶ 0028 0328 and 0329. Applicant is reminded that the claims and only the claims form the metes and bounds of the invention and limitations appearing in the specification but not recited in the claim are not read into the claim and the Examiner has full latitude to interpret each claim in the broadest reasonable sense. Hence, Adriani et al. prior art of Electric-field-induced aggregation in dilute colloidal suspensions creates the liquid environment with the negative conclusion cited in the Office Action dated May 22, 2007 on page 5, lines 7-24 and page 6, lines 1-3. Again, the applicant is invited to submit the requested §105 test data of ¶ 4. above. Short of

such test data, there simply is no basis to believe that the applicant's invention will function as disclosed.

In reference to Applicant's argument:

The Examiner rejected claims 21-41 under 35 U.S.C. 101, arguing that the claimed invention lacks patentable utility. The Examiner argued that the neural network that is claimed cannot develop and the whatever network that may develop, cannot function as a neural network because it is not a neural network ... chains are not neural networks. The Applicant respectfully disagrees with this assessment. Applicant does not use "chains" and the Hong reference demonstrates connections that could be adapted for use in a neural network by applying Applicant's claimed invention. Applicant's invention does provide patentable utility...what is more "utilitarian" than a nanometer-scale physical neural network? Applicant's specification indicates that the physical neural network of Applicant's invention would be much faster than any present software-based neural network solutions. Regarding utility, Applicant's specification provides many examples of utility. FIGS. 14-18 of Applicant's specification, for example, describe a chip-implementation of Applicant's invention. This constitutes one example a practical application for practicing Applicant's invention, particularly in light of the features demonstrated by the Hong reference.

Examiner's Response:

The cited prior art of Adriani et al sets forth the basis that the applicant' s invention will not function as disclosed. Applicant is invited to submit the requested § 105 data of ¶ 4. above.

In reference to Applicant's argument:

The Examiner rejected Claims 24-44 under 35 USC 112, first paragraph by arguing that current case law (and accordingly, the MPEP) require such a rejection if a 101 rejection is given because when Applicant has not in fact disclosed the practical application for the invention, as a matter of law there is no way Applicant could have disclosed how to practice the undisclosed practical application.

The Applicant respectfully disagrees with this assessment. As indicated previously, Applicant does not use "chains" and the Hong reference demonstrates connections that could be adapted for use in a neural network by applying Applicant's claimed invention. Applicant's invention does provide patentable utility...what is more "utilitarian" than a nanometer-scale physical neural network? Applicant's specification indicates that the physical neural network of Applicant's invention would be much faster than any present software-based neural network solutions. Regarding utility, Applicant's specification provides many examples of utility. FIGS. 14-18 of Applicant's specification, for example, describe a chip- implementation of Applicant's invention. This constitutes one example a practical application for practicing Applicant's invention, particularly in light of the features demonstrated by the Hong reference.

Examiner's Response:

For the reasons stated in ¶ 8. above, the rejection of 35 USC ¶112, first paragraph, related to the 35 USC 101 rejection remains.

In reference to Applicant's argument:

Claims Rejections, 35 U.S.C. § 102 / § 103

The Examiner argued that claims 24-44 fail to identify an invention (neural network) that can be evaluated under the conditions of novelty or nonobviousness. The Examiner argued that the approach taken using nanoconductors fails to produce a neural network. The Examiner also asserted that the claims as written have no basis in reality and cannot be evaluated because the invention doesn't and cannot exist.~ The Examiner further argued that if the Applicant is not claiming a neural network, then the chains of Adriani and the dipoles of Jordan anticipate the applicant's invention. The Applicant respectfully disagrees with this assessment. Applicant has identified an invention that can be evaluated under the conditions of novelty or nonobviousness. The approach taken by Applicant can provide for a neural network. Applicant's specification and the Hong reference provide sufficient evidence to make this point. Applicant's invention does have a basis in reality (i.e., see Hong reference for forming connections in a gap). Additionally, as indicated previously, neither Adrianai nor Jordan anticipate Applicant's invention and further, Applicant's invention does not form chains nor utilize such "chains".

Examiner's Response:

The above discussions apply. Rejection remains. From applicant's statement in the response dated July 25, 2007, lines 5-6, applicant simply has no test data confirming reduction to practice. Constructive reduction to practice has been eliminated by ¶ 5. above.

Applicant is invited to submit test data responding to ¶ 4. above.

Examination Considerations

13. The claims and only the claims form the metes and bounds of the invention. "Office personnel are to give the claims their broadest reasonable interpretation in light of the supporting disclosure. *In re Morris,* 127 F.3d 1048, 1054-55, 44USPQ2d 1023,

1027-28 (Fed. Cir. 1997). Limitations appearing in the specification but not recited in the claim are not read into the claim. *In re Prater*, 415 F.2d, 1393, 1404-05, 162 USPQ 541, 550-551 (CCPA 1969)" (MPEP p 2100-8, c 2, l 45-48; p 2100-9, c 1, l 1-4). The Examiner has full latitude to interpret each claim in the broadest reasonable sense. Examiner will reference prior art using terminology familiar to one of ordinary skill in the art. Such an approach is broad in concept and can be either explicit or implicit in meaning.

14. Examiner's Notes are provided with the cited references to prior art to assist the applicant to better understand the nature of the prior art, application of such prior art and, as appropriate, to further indicate other prior art that maybe applied in other office actions. Such comments are entirely consistent with the intent and spirit of compact prosecution. However, and unless otherwise stated, the Examiner's Notes are not prior art but a link to prior art that one of ordinary skill in the art would find inherently appropriate.

15. Unless otherwise annotated, Examiner's statements are to be interpreted in reference to that of one of ordinary skill in the art. Statements made in reference to the condition of the disclosure constitute, on the face of it, the basis and such would be obvious to one of ordinary skill in the art, establishing thereby an inherent prima facie statement.

16. Examiner's Opinion: ¶¶ 13.-15. The Examiner has full latitude to interpret each claim in the broadest reasonable sense.

Conclusion

17. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

18. Claims 21-41 are rejected.

Correspondence Information

19. Any inquiry concerning this information or related to the subject disclosure should be directed to the Primary Examiner, Joseph P. Hirl, whose telephone number is (571) 272-3685. The Examiner can be reached on Monday – Thursday from 5:30 a.m. to 4:00 p.m.

As detailed in MPEP 502.03, communications via Internet e-mail are at the discretion of the applicant. Without a written authorization by applicant recorded in the applicant's file, the USPTO will not respond via e-mail to any Internet correspondence which contains information subject to the confidentiality requirement as set forth in 35 U.S.C. 122. A paper copy of such correspondence will be placed in the appropriate patent application. The following is an example authorization which may be used by the applicant:

> Notwithstanding the lack of security with Internet Communications, I hereby authorize the USPTO to communicate with me concerning any subject matter related to the instant application by e-mail. I understand that a copy of such communications related to formal submissions will be made of record in the applications file.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, David R. Vincent can be reached at (571) 272-3080.

Any response to this office action should be mailed to:

Commissioner of Patents and Trademarks,

Washington, D. C. 20231;

Hand delivered to:

Receptionist,

Customer Service Window,

Randolph Building,

401 Dulany Street,

Alexandria, Virginia 22313,

(located on the first floor of the south side of the Randolph Building);

or faxed to:

(571) 273-8300 (for formal communications intended for entry.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have any questions on access to Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll free).

Joseph P. Hirl
Primary Examiner
September 4, 2007